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# PHILOSOPHICAL TRANSACTIONS.

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July 18. 1670.

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*A Letter of Doctor John Wallis to Robert Boyle Esq; concerning the said Doctors Essay of Teaching a person Dumb and Deaf to speak, and to understand a Language; together with the success thereof, made apparent to his Majesty, the Royal Society, and the University of Oxford. A Relation concerning the Sal-Gemme-Mines in Poland, deep 200 Fathoms. The way of making Vinegar in France. An Account of some Books: I. MECHANICA sive De MOTU Tractatus Geometricus; PARS SECUNDA, in qua De CENTRO GRAVITATIS Ejusque CALCULO, Auth. Johanne Wallis S. Th. D. & Geometria Prof. Saviliano, &c. II. EXERCITATIONES MECHANICÆ, Alexandri Marchetti. III. The Natural History of NITRE, by William Clark.*

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*A Letter of Dr. John Wallis to Robert Boyle Esq, concerning the said Doctor's Essay of Teaching a person Dumb and Deaf to speak, and to Understand a Language; together with the success thereof: Which Letter though written many years since, was but lately obtain'd to be inserted here, it being esteem'd very well worth to be preserv'd and communicated for Publick Use.*

SIR,

I Did acquaint you a while since, That (beside the consideration of . . . . ., which I had in hand;) I had undertaken another Talk, (almost as hard as to make Mr. . . . . understand Reason,) to Teach a person

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son *Dumb* and *Deaf*, to *Speak* and to *Understand* a *Language*. Of which if he could do either, the other would be more easy : But his knowing neither, makes both harder. And though the Former may be thought the more difficult; the Latter may perhaps require as much of Time. For if a considerable Time be requisite, for him that can speak One, to learn a Second Language; much more for him that knows None, to learn the First.

I told you, in my last, that my *Mute* was now at least *Semivocalis*, whereof because you desire a more particular Information, I thought my self obliged to give you this brief Account of that whole Affair: that you may at once perceive, as well, upon what considerations I was induced to Attempt that Work, and what I did propose to my self as Feasible therein, as what Success hath hitherto attended that Essay.

The Task it self consists of Two very different parts; each of which doth render the other more difficult. For, beside that which appears upon the first view, To teach a person who *cannot Hear*, to *Pronounce the Sound of Words*: There is that other, of teaching him to *Understand a Language*, and know the signification of those words, whether spoken or written, whereby he may both express his own sense, and understand the Thoughts of others: without which latter, that former were only to speak like a Parrot; or to write like a Scrivener, who understanding no Language but English, transcribes a piece of *Latin*, *Welsh*, or *Irish*; or like a Printer of Greek or Arabick, who knows neither the sound nor signification of what he printeth.

Now, though I did not apprehend Either of these impossible; yet, that each of them doth render the other more hard, was so obvious as that I could not be Ignorant of it. For, how easily the understanding of a Language is attain'd by the benefit of Discourse, we see every day; not onely in those, who knowing one Language already, are now to learn a second; but (which doth more resemble the present case) in Children, who as yet knowing none, are now to learn their First Language. For

For it is very certain, that no Two Languages can be so much different the one from the other, but that the knowledge of the one will be subservient to the gaining of the other : not only because there is now a common Language, wherein the Teacher may Interpret to the Learner the signification of those Words and Notions which he knows not, and express his own Thoughts to him ; but likewise (which is very considerable;) because the *common Notions of Language*, wherein all or most Languages do agree, and also so many of the Particularities thereof as are common to the Language he knows already, and that which he is to learn, (which will be very many.) are already known ; and therefore a very considerable part already dispatched, of that work which will be necessary for the teaching of a First Language, to him who as yet knows none.

But to this disadvantage (of teaching a First Language,) when that of *Deafness* is super-added, it must needs augment the difficulty : since it is manifestly evident from Experience, That the most advantageous way of teaching a Child his First Language, is that of *perpetual Discourse*; not onely what is particularly addressed to himself, as well in pleasing divertisements, or delightful sportings, (and therefore insinuates it self without any irksom or tedious labour,) as what is directly intended for his more serious Information : But that discourse also which passeth between others; where, without pains or study, he takes notice of what Actions in the Speaker do accompany such words, and what Effects they do produce in those to whom they are directed ; which doth, by degrees, insinuate the intendments of those words.

And, as that Deafness makes it the more difficult to teach him a Language : so on the other hand, that want of Language, makes it more hard to teach him how to speak or pronounce the Sounds. For there being no other way to direct his Speech, than by teaching him how the Tongue, the Lips, the Palate, and other Organs of speech, are to be applyed and moved in the Forming of such sounds as are required ; to the end that he may, by *Art*, pronounce those

Sounds, which others do by *Custom*, they know not how ; it may be thought hard enough to express in writing, even to one who understands it very well, those very nice Curiosities and Delicacies of motion , which must be observed (though we heed it not,) by him, who without help of his Ear to guide his Tongue, shall form that variety of Sounds we use in speaking : Many of which Curiosities are so nice and delicate, and the difference in forming those Sounds so very subtle, that most of our selves, who pronounce them every day, are not able, without a very serious consideration, to give an account, by what Art or Motion our-selves form them ; much less to teach another how it is to be done. And if, by writing to one who understands a Language, it be thus difficult to give Instruction, how, without the help of Hearing, he may utter those Sounds, it must needs increase the Difficulty, when there is no other Language to express it in, but that of Dumb signs.

These Difficulties (of which I was well aware ) did not yet so far discourage me from that undertaking, but that I did still conceive it possible that both parts of this Task might be effected.

As to the First of them ; Though I did not doubt but that the Ear doth as much guide the Tongue in speaking, as the Eye doth the Hand in writing, or playing on the Lute : and therefore those who by accident do wholly lose their Hearing, lose also their Speech, and consequently become Dumb as well as Deaf ; ( for it is in a manner the same difficulty, for one that Hears not, to speak well ; as for him that is blind, to write a fair hand : ) yet, since we see that 'tis possible for a Lady to attain so great a Dexterity, as, in the dark, to play on a Lute, though to that variety of nimble motions, the Eyes direction, as well as the Judgment of the Ear, might seem necessary to guide the Hand ; I did not think it impossible, but that the Organs of Speech might be taught to observe their due Postures, though neither the Eye behold their Motion, nor the Ear discern the Sound they make.

And as to the other ; That of Language might seem yet  
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more possible. For, since that in Children, every day, the Knowledge of words, with their various Constructions and Significations, is by degrees attained by the Ear; so that, in a few years, they arrive to a competent ability of Expressing themselves in their first Language, at least as to the more usual Parts and Notions of it; Why should it be thought impossible, that the Eye (though with some disadvantage) might as well apply such Complication of Letters or other Characters, to represent the various Conceptions of the mind, as the Ear, a like Complication of Sounds? For though, as things now are, it be very true that Letters are, with us, the immediate Characters of Sounds, as those Sounds are of Conceptions: yet is there nothing, in the nature of the Thing it self, why Letters and Characters might not as properly be applyed to represent Immediately, as by the Intervention of Sounds, what our Conceptions are.

Which is so great a Truth, ( though not so generally taken notice of,) that 'tis Practiced every day; not onely by the *Chineses*, whose whole Language is said to be made up of such Characters as to represent Things and Notions, independent on the Sound of words; and is therefore differently spoken, by those who differ not in the Writing of it: (like as what, in Figures, we Write, 1, 2, 3, for *One, Two, Three*; a Frenchman, for example, reads *Un, Deux, Trois*;) But, in part, also amongst our selves; as in the Numeral Figures now mentioned, and many other Characters of Weights and Metals, used indifferently by divers Nations to signify the same Conceptions, though expressed by a different Sound of words: And, more frequently, in the practice of Specious Arithmetick, and operations of Algebra, expressed in such Symbols, as so little need the Intervention of Words to make known their meaning, that, when different persons come to express, in Words, the sense of those Characters, they will as little agree upon the same Words, though all express the same sense, as two Translators of one and the same Book into another Language.

And, though I will not dispute the Practical possibility  
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of introducing an *Universal Character*, in which all Nations, though of different speech, shall express their common Conceptions; yet, that some Two or Three (or more) persons may, by consent, agree upon such Characters, whereby to express each to other their sense in Writing, without attending the Sound of words; is so far from an impossibility, that it must needs be allowed to be very Feasible, if not Facile. And, if it may be done by new-invented Characters; why not as well by those already in use? Which though to those who know their common use, may signify Sounds; yet to those that know it not, or do not attend it, may be as immediately applied to signify Things or Notions, as if they signified nothing else: And consequently, so long as it is purely Arbitrary, by what Character to express such a Thing or Notion; we may as well make use of that Character or Collection of Letters, to express the Thing to the Eyes of him that is Deaf; by which others express the Sound or Name of it to those that Hear. So that, indeed, that shall be, to Him, a Real Character, which expresseth to Another a vocal Sound; but signifieth, to Both, the same Conception: Which is, To understand the Language.

To these Fundamental Grounds of Possibility in Nature, I am next to add a Consideration which made me think it Morally-possible; that is, not impossible to succeed in Practice. And, because I am now giving an Account to one who is so good a Friend to Mathematicks, and Proficient therein, I shall not doubt but this Consideration will have the force of a great swasive. Considering therefore, from how few and despicable Principles the whole Body of Geometry, by continual consequence, is enforced; if so fair a Pile, and curious Structure may be raised, and stand fast upon so small a Bottom; I could not think it incredible, that we might attain some considerable success in this Design, how little soever we had at first to begin upon: and, from those little Actions and Gestures, which have a kind of Natural significancy, we might, if well managed, proceed gradually to the Explication of a compleat Language, and withal, direct to those curiosities of Motion and Posture

sture in the Organs of speech, requisite to the Formation of a Sound desired ; and, so to effect both parts of what we intend.

My next Inducement to undertake it, was a consideration of the Person, (which, in a work of this nature, is of no small concernment ; ) who was represented to me as very Ingenious and Apprehensive, (and therefore a fit subject to make an Essay upon ; ) and so far at least a Mathematician as to Draw Pictures ; wherein, I was told, he had attained some good ability, which did induce me to believe that he was not incapable of the Patience, which will be necessary to attend the Curiosity of those little varieties in the Articulation of Sounds ; being already accustomed to observe and imitate those little Niceties in a Face, without which it is not possible to Draw a Picture well.

I shall add this also, That, once, he could have spoken, though so long ago, that (I think) he doth scarce remember it. But having, by accident, when about five years of age lost his Hearing, he consequently lost his speech also ; not all at once, but by degrees, in about half a years time : which though it do confirm what I was saying but now, How needful it is for the Ear to guide the Tongue in Speaking, (since that Habit of Speaking, which was attained by Hearing, was also lost with it,) and might therefore discourage the undertaking ; yet I was thereby very much secured, that his want of Speech was but a consequent of his want of Hearing, and did not proceed originally from an Indisposition in the Organs of Speech to form those Sounds. And though the neglect of it in his younger years, when the Organs of Speech, being yet tender, were more pliable, might now render them less capable of that Accurateness which those of Children attain unto : (whereof we have daily experience ; it being found very difficult, if not impossible, to teach a Forraigner well in years, the Accurate pronouncing of that Sound or Language, which in his tender years he had not learned :) yet, if he can attain to speak but so well as a Forraigner, at his years, may learn to speak English ; what shall be farther wanting to that Accurateness which a Native



Native from his Childhood attains unto, may, to an indifferent estimate, be very well dispensed with.

Having thus acquainted you with those Considerations which did induce me to attempt it; least you may think I build too confidently thereupon, and judge me guilty of too much vanity, in promising my self a greater success than can, in reason, be hoped for; It will next be necessary to give you some account, what measure of Success I might propose to my self as probable, in such an undertaking.

And as to the first part of it, (that of *Speaking*;) Though I did believe, that much more is to be effected than is commonly thought Feasible, and that it was possible for him so to speak as to be understood; yet I cannot promise my self, that he shall speak so Accurately, but that a Critical ear may easily discern some Failures, or little differences from the ordinary tone or pronunciation of other men; (since that we see the like every day, when not Forraigners only, but those of our own Nation in the remoter parts of it, can hardly speak so Accurately, as not to discover a considerable difference from what is the common Dialect or Tone at *London*.) And this not onely upon the consideration last mentioned; (concerning the Organs of Speech less pliable to those Sounds to which they were not from the first accustomed;) but especially upon that other consideration, concerning the Ears usefulness to guide and correct the Tongue. For as I doubt not, but that a Person, who knows well how to Write, may attain, by custome, such a Dexterity, as to write in the Dark tolerably well; yet it could not be expected, that he should perform it with the like Elegancy, as if he saw the Motions of his hand: so neither is it reasonably to be expected, that he who cannot Hear, though he may know how to speak Truly, should yet perform it so Accurately, as if he had the advantage of his Ear also.

Nor can I promise, nor indeed hope, that how Accurately soever he may learn to speak, he should be able to make so great Use of it as others do. For since that he cannot hear what others say to Him, as well as express his own Thoughts

to Them; he cannot make such use of it in Discourse as others may. And though it may be thought possible, that he may, in time, discern, by the motion of the Lips, visible to the Eye, what is said to him; (of which I am loth to deliver a positive judgment, since much may be said conjecturally both ways;) yet this cannot be expected, till at least he be so perfectly Master of the Language, as that, by a few Letters known, he may be able to Supply the rest of the Word; and by a few Words, the rest of the Sentence, or at least the sense of it, by a probable conjecture, (as when we Decipher Letters written in Cipher :) For, that the Eye can actually discern all the varieties of Motion in the Organs of Speech, and see what Sounds are made by those Motions, (of which many are Inward, and are not exposed to the Eye at all,) is not Imaginable.

But as to the other Branch of our Design, concerning the Understanding of a Language: I see no reason at all to doubt, but that he may attain This, as perfectly as those that Hear; and that, allowing the like Time and Exercise, as to other men is requisite to attain the Perfection of a Language, and the Elegance of it, he may Understand as well, and Write as Good Language as other men; and (abating onely what doth directly depend upon Sound, as Tones, Cadencies, and such Punctilio's,) no whit inferiour to what he might Attain to, if he had his Hearing as others have. And what I speak of him in particular, I mean as well of any other Ingenious person in his Condition; who, I believe, might be taught to use their Book and Pen as well as others, if a right Course were taken to that purpose.

To tell you next, What Course I have hitherto used towards this Design, it will not be so necessary. For should I descend to Particulars, it would be too Tedious; especially since they are to be used very differently, and varied as the present Case and Circumstances do require. And, as to the General way, it is sufficiently Intimated already.

As to that of Speech; I must first, by the most significant signs I can, make him to understand, in what Posture and Motion I would have him apply his Tongue, Lips, and  
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other Organs of Speech, to the Forming of such a Sound as I direct. Which if I hit right, I confirm him in it : If he miss, I signifie to him, in what he differed from my Direction; and, to what Circumstances he must attend to mend it. By which means, with some Trials, and a little Patience, he learns first one, then another Sound ; and, by frequent Repetitions, is confirmed in it ; or (if he chance to forget) Recovers it again.

And for this Work, I was so far prepared before hand, that I had heretofore, upon another occasion, (in my Treatise *De Loquela*, prefixed to my *Grammar* for the *English Tongue*,) considered very exactly (what few Attend to) the Accurate Formation of all Sounds in Speaking, (at least as to our own Language, and those I knew :) without which, it were in vain to set upon this Task. For, if we do not know, or not consider, how we Apply our own Organs in Forming those Sounds we Speak, it is not likely, that we shall, this way, Teach another.

As to that of Teaching him the Language: I must (as Mathematicians do from a Few Principles first granted,) from that little stock (that we have to Begin upon) of such Actions and Gestures as have a kind of Natural significancy, or some Few Signs, which himself had before taken up to express his Thoughts as well as he could, Proceed to Teach him, what I mean by somewhat else ; and so, by steps, to more and more : And this, so far as well I can, in such Method, as that what he Knows already, may be a step to what he is next to Learn ; as, in Mathematicks, we make use, not of Principles only, but Propositions already demonstrated, in the Demonstration of that which follows.

It remains now, for the Perfecting the Account which at present you desire of me, only to tell you, what Progress we have already made. Which, had not your Desires commanded from me, I should have respited a while longer, till I might have made it somewhat Fuller.

He hath been already with me somewhat more than Two Months. In which time, though I cannot be thought to have Finished such a Work ; yet the Success is not so little,

( 1097 )

as to Discourage the Undertaking: but as much as I could hope for in so short a time; and more than I did Expect. So that I may say, the Greatest difficulty of Both Parts being almost over; what Remains, is little more than the work of Time and Exercise. There is hardly any Word, which (with deliberation) he cannot Speak; but, to do it Accurately, and with Expedition we must allow him the Practice of some considerable Time, to make it familiar to him.

And, as to the Language; though it were very Indifferent to him who Knew none, which to begin withal; yet, since it is out of Question, that *English*, to him, is like to be the most Useful and Necessary; it was not adviseable to Begin with any other. For though he can Pronounce the Latine with much more Ease, (as being less perplexed with a multitude of concurring Consonants;) yet this is a Consideration of much less concernment than the other.

To this therefore having applyed himself, he hath already Learned a great many Words, and, I may say, a considerable part of the *English*, as to Words of most Frequent use: But the whole Language being so Copious, though otherwise Easy, will require a longer Time to Perfect what he hath Begun.

And this, Sir, is the full History of our Progress hitherto. If you shall hereafter esteem our Future Success, worthy your taking notice of, You may Command that, or what else is within the power of

Oxford,  
March 14. 1662,

S I R,

Your Honours very humble  
Servant,

John Wallis.

THE Person, to whom the foregoing Letter doth refer, is Mr. *Daniel Whaley* ( Son of Mr. . . . . *Whaley*, late of *Northampton*, and Mayor of that Town.) He was (soon after the date of this Letter) on the 21 of *May*, 1662. present at a Meeting of the *R. Society* ( of which the *Register* of that days proceedings takes particular notice,) and did in their presence, to their great satisfaction, pronounce distinctly enough such words as by the Company were proposed to him; and though not altogether with the usual Tone or Accent, yet so as easily to be understood: Whereupon also the said Doctor was, by the same Assembly, encouraged to pursue what he had so ingeniously and so successfully begun. About the same time also ( His Majesty having heard of it, and being willing to see him) he did the like several times at *Whitehall*, in the presence of His Majesty, His Highness Prince *Rupert*, and divers others of the Nobility, though he had then employed but a small time in acquiring this ability. In the space of one year, which was the whole time of his stay with Dr. *Wallis*, he had read over a great part of the English Bible, and had attained so much skill as to express himself intelligibly in ordinary affairs; to understand Letters written to him, and to write Answers to them, though not elegantly, yet so as to be understood: And in the presence of many Forraigners (who out of Curiosity have come to see him,) hath oft-times, not only read *English* and *Latin* to them, but pronounced the most difficult words of their Languages (even *Polish* it self,) which they could propose to him. Since that time, though he hath not had opportunity of making much further improvement for want of an Instructour, yet he doth yet retain what he had attained to; or, wherein he may have forgot the niceness requisite in the pronounciation of some Sounds, doth easily recover it with a little help.

Nor is this the only Person on whom the said Doctor hath shewed the effect of his skill, but he hath since done the like for another ( a young Gentleman of a very good Family,

Family, and a fair Estate,) who did from his birth want his Hearing. On this occasion I thought it very suitable to give notice of a small *Latin* Treatise, of this same Authour, first Published in the year 1653, intituled *De Loquela* [of Speech,] prefixed to his *Grammar of the English Tongue* (Written also in *Latin*.) In which Treatise of Speech (to which he refers in this discourse, and on confidence of which he durst undertake that difficult task) he doth very distinctly lay down the manner of forming all Sounds of Letters usual in Speech, as well of the English, as of other Languages; which is, I think, the first Book ever Published in that kind, (for, though some Writers formerly have here and there occasionally said something of the Formation of some particular Letters; yet none, that I know of, had before him undertaken to give an account of all.) Whether any, since him, have with more judgment and accurateness performed the same, I will not take upon me at all to determine. In his *Grammar of the English Tongue* (to which this *of Speech* is prefixed) he hath so briefly and clearly given an account of this Language, as may be very advantageous; not only to Strangers, for the easy attainment thereof, but even to the English themselves for the clear discovering (which few take notice of) the true *genius* of their own Language.

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### A Relation,

*Concerning the Sal-Gemme-Mines in Poland; communicated by a Curious Gentleman of Germany, who, some years since, descended himself into those Mines, to the depth of 200 Fathoms, and was led about in them for the space of three hours.*

THE Mines of *Sal-Gemme* in *Poland*, a mile distant from *Cracovia*, near the small Town of *Wilizka*, which (the Church excepted) is altogether digged hollow under ground,